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(54) Title: **RECYCLABLE CROSSLINKED POLYMERS WITH SATURATED MAIN CHAIN AND THERMALLY REVERSIBLE URETHANE CROSSLINK POINTS**

(57) Abstract: The invention relates to thermoplastic cross-linked polymer compound with thermally reversible urethane crosslinkages comprising the following essential components a) to d): a) a thermoplastic polymer component with saturated molecular main chain; b) a component containing isocyanate group(s), either attached to the polymer chain or being present in mobile form in the polymer matrix; c) a component containing hydroxyl group(s) either attached to the polymer chain or being present in mobile form in the polymer matrix; d) a catalyst package promoting the reversible formation and thermal dissociation of urethane bonds, characterized in that at least one of the components b) and c) is attached to the polymer chain and at least one of the additives present in the compound is multi-functional, playing a role in more than one, functionally independent processes. The invention further relates to a process for preparing such compounds by: a) preparing a first additive package containing the monomer(s) of one of the components b) and c) to be grafted and the radical source and a processing aid, by mixing the processing aid first with the radical source, then with other component(s), b) preparing a second additive package containing the other urethane forming component not present in the first additive package, the processing aid, the urethane catalysts and, if both the hydroxyl and the isocyanate components are to be grafted, the radical source, such as peroxide, by mixing first the processing aid with the solid components, then with other component(s), c) melting the thermoplastic polymer, d) mixing the first additive package with the molten polymer at a temperature where the grafting reaction is complete within a few minutes, e) mixing the second additive package with the molten polymer obtained in step, d) at a temperature where the urethane formation reaction is complete within a few minutes, f) followed by proper shaping (e.g. extrusion/granulation, injection, etc.) the compound and cooling down.

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